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ORIGINAL ARTICLE

Comparison of autologous platelet rich plasma dressing versus normal saline dressing in the management of heel pad injuries due to motorcycle wheel spoke.

Jannat Gulzar[1], Fatima Naumeri[2]

ABSTRACT… Objective: To compare the outcome of autologous platelet rich plasma dressing with normal saline dressing in the management of heel pad injuries due to motorcycle wheel spoke. **Study Design:** Randomized Controlled Trial. **Setting:** Department of Pediatrics Surgery, Services Hospital, Lahore. **Period:** April 2024 to April 2025. **Methods:** After meeting selection criteria, 60 (30 in each group) patients were enrolled and randomly allocated in two groups using computer generated table. In group A, platelet rich plasma was applied. In group B, normal saline dressing was applied. After 12th week outcomes in terms of reduction in horizontal and longitudinal wound dimensions, complete healing and duration of healing were noted. **Results:** In PRP group, the reduction in longitudinal size was 77.11%±23.89 and in normal saline group, was 51.47%±21.70 (p-value=<0.001). In PRP group, the reduction in horizontal size was 74.05%±21.51 and in normal saline group, was 48.39%±21.37 (p-value=<0.001). In PRP group, the mean duration of healing was 15.87±5.42 days and in normal saline group, was 18.83±7.19 days (p-value=0.076). In PRP group, complete healing was found in 13(43.3%) patients and in normal saline group, it was found in 2(6.7%) patients (p-value=0.001). **Conclusion:** Autologous platelet rich plasma dressing showed better outcome as compared to normal saline dressing in the management of heel pad injuries due to motorcycle wheel spoke in terms of complete healing, duration of healing and reduction in wound size.

Key words: Autologous Platelet Rich Plasma, Heel Pad Injuries, Motorcycle Wheel Spoke Injuries, Normal Saline, Pediatric Wounds, Wound Dressings.

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INTRODUCTION

For the Impoverished people of Pakistan, motorcycles are a common mode of transportation. Motorbike spoke wheel injuries occur when a person's foot becomes trapped in the wheel's revolving spokes.[1] These mishaps and injuries are more likely to occur in children less than 10 years. It occurs when they hang their foot because they are unable to reach the foot resting stand.[2] The reported incidence is 21.7% in one of Pakistan's largest cities.[3,4]

These complex injuries heal in three phases: remodeling, proliferation, and inflammation which involve hemostasis, inflammation, granulation tissue creation, epithelialization, neovascularization, collagen synthesis, and wound contraction.[5]

The healing phase may be enhanced by many factors, PRP (Platelet Rich Plasma) is one of such interventions as demonstrated remarkable outcomes in terms of improved healing and epithelization time. PRP is centrifuged from the plasma that contains growth factors, transforming growth factor-ß, platelet-derived epidermal growth factor, vascular endothelial growth factor, insulin-like growth factor-1, fibroblastic growth factor, and epidermal growth factor, all of which promote wound healing, when come into contact with exposed endothelium in wounds through tissue-repair mechanisms like chemotaxis, cell proliferation, angiogenesis, extracellular matrix deposition, and remodeling. Based on this evidence application of PRP in damaged tissue would raise the amounts of several bioactive substances and enhance the body's natural healing process.[6]

Based on the existing published literature, PRP dressing may be more effective than the regular saline dressings.

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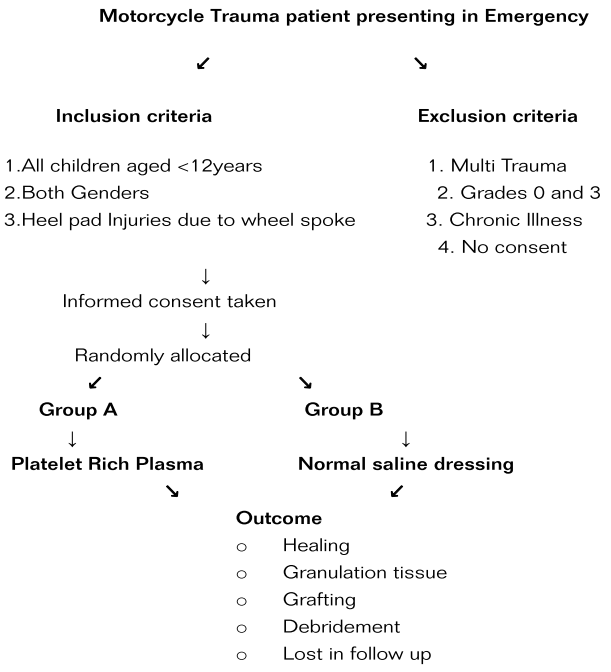
However, the current literature mostly focused on chronic wounds among adult population.[7,8] Therefore, we wanted to conduct this study to get evidence regarding the role of platelet rich plasma for pediatric population and implement more appropriate methods for early healing of wound due to wheel spoke and improve our management protocol.

METHODS

After approval from institutional review board (IRB/2023/1091/SIMS), this Randomized controlled trial was carried out at the Department of Pediatrics Surgery, Services Hospital, Lahore form April 2024 to April 2025. Sample size was 60 children; 30 in each group is calculated with 90% power of study, 5% significance level and percentage of complete healing i.e. 25% with platelet rich plasma while 0% in normal saline dressing. Children were enrolled by using non-probability, consecutive Sampling techniques. Children aged below 12 years, both genders, presenting with heel pad injuries due to motorcycle wheel spoke were included in the study while children with grades 0 or 3 according to Oestern and Tscherne classification and children with chronic illness were excluded.

FIGURE-1

Flowchart showing eligibility criteria, allocation, intervention and outcomes.



Informed consent was obtained from parents. Demographics (name, age, gender, weight, duration of injury, site and side involved) were noted. At the time of enrollment, baseline length and width of wound in centimeters were measured using a standard inch tape and pictorial documentation was done. Patients were allocated two groups by using computer generated table. In group A, as seen in Fig1, platelet rich plasma dressing was applied after every 3 days for 4 weeks. In group B, normal saline dressing was applied daily for 4 weeks. About 10ml venous blood sample was taken into centrifuge tube to the pathology department for preparation of platelet rich plasma where it was centrifuged for ten minutes at a speed of 1500 RPM. The leftover plasma would then be spun again at 2000 RPM for five minutes once the poor plasma collected has been removed. Then the buffy coat over the plasma was removed and platelet rich plasma was applied over the cleaned wound for three days. Children were followed up in OPD. If wound was healed completely (Granulation of tissues) within 12 weeks, then complete healing was labeled. Total duration of healing in all patients was also noted until granulation occurred and reduction in wound size clinically observed. After 12 weeks, the length and width of wound were taken again and percentage reduction in these dimensions was calculated by dividing size at end of study from baseline value and then multiply with 100. All children were managed as per standard hospital protocol. All data was entered into specially designed Proforma.

Data was entered & analysed by using SPSS version 21. Both groups were compared for duration of healing, percentage reduction in length and width by using independent samples t-test and for percentage change and complete healing by using chi-square test. P-value <0.05 was taken as significant.

RESULTS

Table-I gives demographic details of all patients enrolled including mean age,gender ,mean height and weight, mean duration of injury and the area involved.

At baseline, the mean longitudinal size was 3.90±1.73 in group A while 4.87±4.87 in group B (p-value = 0.06). After 12th week; the mean

longitudinal size was 1.13±1.25 in group A while 2.45±1.27 in group B (p-value < 0.001) At baseline, the mean horizontal size was 3.03±1.57 in group A, while 3.60±1.06 in group B (p-value = 0.108). After 12th week; the mean horizontal size was 0.90±0.77 in group A while 1.87±0.89 in group B (p-value < 0.001).). In group A, the reduction in longitudinal size was 77.11% ±23.89 and in group B, was 51.47% ±21.70 (p-value < 0.001). In group A, the reduction in horizontal size was 74.05%±21.51 and in group B was 48.39%±21.37 (p-value < 0.001). the results tabulated in Table-II.

In group A, the mean duration of healing was 15.87±5.42 days and in group B, was 18.83±7.19 days with no statistical difference (p-value = 0.076). In group A, complete healing was found in 13 (43.3%) children and in group B, it was found in 2 (6.7%) children p-value of 0.001). Table-III

DISCUSSION

This study demonstrated that PRP caused significant reduction in the wound size as compared to normal saline both longitudinally and horizontally in 12 weeks. In terms of complete healing, PRP group did not insignificantly differ than saline dressing group (15.8 vs 18.83) Also, in PRP group, complete healing was observed in 13(43.3%) cases while in normal saline group 2(6.7%) cases achieved complete healing within defined period of 12 weeks. (p-value = 0.001) making PRP a better choice in the management of children suffering from wheel spoke injuries wound.

TABLE-I

Baseline demographics of children enrolled in the trial (n = 60)

Characteristics		PRP Dressing Group A (n=30)	Normal Saline Dressing Group B (n=30)	P-Value
Age (Years)		6.20 ± 3.11	6.90 ± 2.44	0.34
Gender	Male	19 (63.3%)	14 (46.7%)	0.2
	Female	11 (36.7%)	16 (53.3%)	
Height (cm)		105.90 ± 23.79	89.00 ± 38.35	0.05
Weight (kg)		19.53 ± 4.55	22.97 ± 10.24	0.10
Duration of injury (days)		1.28± 1.18	1.34 ± 1.30	0.84
Foot involved	Left	17 (56.7%)	17 (56.7%)	1.0
	Right	13 (43.3%)	13 (43.3%)	

TABLE-II

Comparison of size of wound at baseline and after 12th week in both trial groups (n = 60) 95%CI= Confidence Interval

Wound Dimensions		Baseline (cm)	After 12 Weeks (cm)	Reduction in Size (%)
Longitudinal Size	Group A	3.90±1.73	1.13 ±1.25	77.11 ± 23.89 CI (68.19,86.03)
	Group B	4.87 ±1.25	2.45 ± 1.27	51.47 ± 21.70 CI (66.01,82.09)
	p-Value	0.016	<0.001	<0.001
	95% CI for difference		(13.88,37.40)	
Horizontal Size	Group A	3.03 ± 1.57	0.90± 0.77	74.05 ± 21.51 CI (66.01,82.09)
	Group B	3.60 ± 1.06	1.87 ± 0.89	48.39 ± 21.37 CI (40.41,56.37)
	p-Value	0.108	<0.001	<0.001
	95% CI for difference		(14.61,36.71)	

FIGURE-2

a: 4 days old wheel spoke injury of the right foot after surgical debridement.
b: 2nd week of PRP dressing.
c: 4th week of continued PRP dressings.
d: 14th week post PRP dressings of right foot wheel spoke injury.

FIGURE-3

a: Right foot Wheel spoke injury at the time of presentation in Emergency.
b: Right foot wheelspoke injury at 12th week post PRP dressing applications.

Elsaid et al., compared platelet rich plasma dressing to regular saline dressing in a similar study among nonhealing diabetic ulcers and found that 25% of patients who received platelet rich plasma dressing experienced full healing, compared to 0% who received normal dressing. With platelet-rich plasma dressing, the percentage decrease in the wound's longitudinal and horizontal diameters was substantially higher than with regular saline (43.2% vs. 4.1%) and (42.3% vs. 8.2%), respectively. When using platelet-rich plasma dressing instead of regular saline, the period needed to achieve maximal healing was substantially shorter (6.3 ± 2.1 vs. 10.4 ± 1.7 weeks, P < 0.0001).[9] Similar results were found in our study although trial population was different.

Singh et al., also conducted a trial and reported that reduction in area of wound at the end of treatment with PRP (12.27 ± 4.10 cm^2 with platelet rich plasma dressing while 9.25 ± 1.89 cm^2 with normal saline.)and PRP resulted in 22.22% wounds to be completely healed while 0% with normal saline.[10] Despite different population for application of PRP the results were corresponding with our study.

Another study conducted by Somani and Rai reported that complete healing was noted in 55.5% cases with PRP but in 0% with normal saline and overall mean reduction in the wound size was 85.51% with platelet rich plasma dressing compared to 42.74% with normal saline dressing when applied in chronic venous ulcers.[11]

Orban et al., showed that recovery was enhanced by using PRP in chronic diabetic wounds as compared to the traditional saline dressings (86.11% cases vs. 63.89% cases, p-value = 0.029). PRP also resulted in a shorter healing period than traditional dressing (10.90 ± 3.40 weeks vs. 13.48 ± 3.37 weeks, respectively; p-value = 0.01).[12] All these studies give evidence that PRP shows promising results when used in complicated wound management.

Another evidence provided by Marwa Ahmed et al shown that the PRP-treated group saw a markedly higher rate of recovery, with 86% of them achieving full healing compared to 68% of the control group. The research group's weekly healing rate peaked within the first eight weeks and then began to fall, suggesting an early application of PRP to the wound increases the rate of recovery hence shortening the time of disease.[13]

In our trial we selected early presenting wounds to achieve higher rates of recovery but one study showed that the platelet-rich plasma group required considerably fewer mean weeks for full healing than the normal saline group when applied among infected diabetic wounds. There was a significant difference noted between the initial and ultimate

infection site areas in the platelet group (542.8) and the normal saline group (277.4). The platelet group's percentage for area decrease (mean 39.25%) is noticeably higher. This suggesting that PRP promotes healing in infective wounds.[6]

However, a Cochrane review noted that data for chronic wounds are of low quality and inconclusive, showing only a modest benefit for diabetic foot ulcers.[14] It is important to highlight that most research focuses on chronic wounds in adults, whereas our trial examines acute traumatic injuries in children, a population that is notably underrepresented in literature.

One limitation was the lack of a detailed, standardized protocol for preparing the PRP in our setup. While no major adverse events were observed, we did not implement a systematic safety monitoring plan. Researches indicate that factors like platelet concentration, leukocyte content, centrifugation methods, and activation techniques can profoundly influence PRP's biological properties.[15] Our failure to quantify these parameters or detail the application's frequency and volume hinders the reproducibility of our results and makes comparisons with other studies difficult.

LIMITATIONS

A primary limitation was the lack of allocation concealment and blinding and increasing chances of bias. Furthermore, as a single-center investigation with a small sample size, the generalizability of our findings to broader pediatric populations and diverse clinical settings is limited. The study also did not assess several other critical outcomes, including pain levels, infection rates, scar quality, functional recovery, caregiver satisfaction, or cost-effectiveness; these are all important factors for determining the full clinical utility of PRP.

CONCLUSION

This randomized controlled trial found that autologous platelet-rich plasma (PRP) dressings enhanced wound size reduction and improved complete healing rates for pediatric heel-pad injuries resulting from motorcycle wheel spokes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Jannat Gulzar:** Conception of idea, data collection, manuscript drafting.
2	**Fatima Naumeri:** Drafting, critical review, data analysis.